इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS 14635 (1999): Polytetrafluoroethylene (PTFE) Materials for Moulding and Extrusion [PCD 12: Plastics]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

भारतीय मानक

संचकन और बर्हिवेधन के लिए पॉलीटेट्राफ्लूरोथलीन (पी टी एफ ई) सामग्री — विशिष्टि

Indian Standard

POLYTETRAFLUOROETHYLENE (PTFE) MATERIALS FOR MOULDING AND EXTRUSION — SPECIFICATION

ICS 83.080.20

© BIS 1999

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

March 1999

Price Group 8

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Plastics Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

Polytetrafluoroethylene is commonly known by its acronym 'PTFE'. It is also referred to TFE resin or TFE fluorocarbon resin, the acronym for the monomer is sometimes used misleadingly by itself to mean the polymer, PTFE.

PTFE was developed from research on new refrigerants within the Du Pont Co, USA. A combination of extreme resistance to chemicals and to very high temperatures, superb electrical properties and unique surface properties made the inroads for the commercial production of the material and after World War II, the polymer became available for critical industrial uses. PTFE is made by a free-radical initiated polymerization of the gaseous monomer, tetrafluoroethylene, in an aqueous medium under pressure. It is available as two major kinds of polymer with various sub-classes within each, namely, granular (coarse-ground powder, finely divided powders), agglomerated forms of the finely divided type, presintered powder, various types fine powders and the dispersion-based polymer.

PTFE is a hard, remarkably tough thermoplastic as compared to most other plastics materials. Its upper use temperature is 260°C and is reported to give ductile rather than brittle failures at temperatures just above absolute zero. The mechanical properties of PTFE at room temperatures are similar to those of medium density polyethylene relatively soft with high elongation;. the properties are retained to a useful extent over the wide range of temperatures. PTFE does not absorb electromagnetic radiation in the visible or ultraviolet range and as such has a very high resistance to outdoor weathering. It has got a very low dielectric constant, loss factor as low or lower than any other material, high dielectric strength, high surface resistivity and high resistance to arcing, which are maintained over both the wide range of temperatures and a very wide range of electrical frequencies. Resistance to chemical, attack was the first property of PTFE that was used in practice and remains a major factor in current application. It has been dissolved in only a very few, very rare chemicals. It is, however, attacked by molten alkali metals and by elemental fluorine and pure oxygen at elevated temperatures. The critical surface tension of PTFE is so low that it provides an excellent anti-stick or release surfaces. Surprisingly, its resistance to wear during rubbing or sliding is poor, which, however, is improved most when PTFE is compounded with chopped glass fibres and many other particulate fillers.

PTFE is selected for a wide range of applications, such as, gaskets, seals, coatings or linings in large tanks or process vessels, component parts of valves, piping (solid, lined or laminated), etc, in chemical process industries; in electrical insulation covering the entire wire, cable and speciality electrical products industry; seal rings in automotive power-steering equipment and automatic transmissions, piston rings in non-lubricated compressor equipments; cookware and bakeware products; coverings on rollers in food processing equipments; xerographic copiers and saw-blades; coatings on snow shovels; cardiovascular grafts, heart patches, ligaments for knees using special forms of PTFE (high strength porous products) architectural fabric making used as roofs in wide variety buildings specially where a large area must be enclosed with minimum support, etc. However, in many applications for which PTFE is functionally satisfactory, it is not used because of its very high cost, being not competitive economically.

The rheological properties of PTFE are so different from usual thermoplastic materials that the common techniques of melt processing (extrusion or injection moulding) are not feasible. A series of techniques have been developed that are unique to PTFE industry and each individual type of operation has its own name in the industry, namely, with granular powders — billet moulding and skiving, sheet moulding, automatic preforming and sintering, ram extrusion; with fine powders — lubricated extrusion; with aqueous dispersion — coating, casting, impregnation, coagulation, etc. Broadly, nearly all the PTFE is processed by forming the resin to an approximation of the final shape at or near room temperature and then completing the operation by heating (sintering) the material at temperature above the melting point and cooling to adjust the crystalline content of the final product.

(*Continued on third cover*)

Indian Standard

POLYTETRAFLUOROETHYLENE (PTFE) MATERIALS FOR MOULDING AND EXTRUSION — SPECIFICATION

1 SCOPE

1.1 This standard covers moulding and extrusion powders of PTFE (Polytetrafluoroethylene) processable by methods similar to those used in powder metallurgy and ceramics. The usual methods for processing thermoplastics are not applicable to these materials because of their unusual viscoelastic properties at processing temperature.

1.2 The materials included in this standard do not cover mixtures of PTFE resin with additives such as colour, fillers, etc. The properties described as those required to identify the various types of powders.

2 NORMATIVE REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of the standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edditions of the standards indicated below:

IS No.	*Title*
2828 : 1964	Glossary of terms used in the plastics industry
4486 : 1967	Recommended methods for the determination of the permitivity and dielectric dissipation factor of electrical insulating materials at power, audio and radio frequencies including metre wavelengths
4905 : 1968	Methods for random sampling
13360 (Part 3/ Sec 1) : 1995/ ISO 1183 : 1987	Plastics — Methods of testing: Part 3 Physical and dimensional properties, Section 1 Density and relative density of noncellular plastics
13360 (Part 5/ Sec 1) : 1996/ ISO 527-1 : 1993	Plastics — Methods of testing: Part 5 Mechanical properties, Section 1 Determination of tensile properties — General principles
13360 (Part 5/ Sec 2) : 1996/ ISO 527-2 : 1993	Plastics — Methods of testing: Part 5 Mechanical properties, Section 2 Determination of tensile properties — Test conditions for moulding and extrusion plastics

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 2828 and the following shall apply.

3.1 Bulk Density

The weight in grams of a volume of 1 000 ml of resin measured under the conditions of the test.

3.2 Creep

The increase in strain with time when a constant force is applied.

3.3 Creep-Strength Limit

That initial stress which will just cause rupture (σ, β, t) or will produce a specified strain $(\sigma\varepsilon, t)$ at a specified time t, at a given temperature and relative humidity.

3.4 Extension $(\Delta L)_t$

The increase in the distance between the gauge marks, expressed in millimetres at time t.

It is given by the equation

$$(\Delta L)_t = L_t - L_0$$

where

L_t = the gauge in length, in millilitres, at any given time t during the test; and

L_0 = the original gauge length, in millimetres, of the specimen after application of a preload but prior to application of the test load.

3.5 Initial Stress

The tensile force per unit area of the initial cross-section within the gauge length.

It is given by the equation:

$$\sigma = \frac{F}{A}$$

where

F = the force, in newtons; and

A = the initial cross-sectional area, mm^2, of the specimen.

The stress is expressed in megapascals.

3.6 Isochronous Stress-Strain Curver

A Cartesian plot of stress versus creep strain, at a specific time after application of the test load.

3.7 Preforming

Compacting powdered PTFE material under pressure in a mould to produce a solid object, called a preform, that is capable of being handled. Moulding and compaction are terms used interchangeably with preforming for PTFE.

3.8 Recovery from Creep

The decrease in strain at any given time after completely unloading the specimen, expressed as a percentage of the strain just prior to the removal of the load.

3.9 Reground Resin

That produced by grinding PTFE material that has been moulded or compacted but has never been sintered.

3.10 Reprocessed Resin

That produced by grinding PTFE material that has been moulded or compacted and sintered.

3.11 Sintering

As it applies to PTFE, is a thermal treatment during which the PTFE is melted and recrystallized by cooling with coalescence occurring during the treatment.

3.12 Skiving

A machining operation during which a continuous film of PTFE material is peeled from the lateral surface of cylinderical sintered moulding.

3.13 Tensile-Creep Strain

The change in length per unit original; length of the gauge length produced by the applied load at any given time during a creep test. It is expressed as a dimensionless ratio or as a percentage.

It is given by the equation:

$$\varepsilon_t = \frac{(\Delta L)_t}{L_0}$$

or

$$\varepsilon_t = \frac{(\Delta L)_t}{L_0} \times 100 \text{ (percent)}$$

3.14 Tensile-Creep Modulus

The relation of initial stress to creep strain, calculated as in **F-5.1**.

3.15 Time to Rupture

The period of time which elapsed between the point in time at which the specimen is fully loaded and the rupture point.

4 TYPES

This specification covers the following four types of PTFE resin which are further classified into various classes, generally used for compression moulding or extrusion or both:

Type I — Granular powder for general purpose moulding and extrusion

Type II — Free flowing granular powder for un-lubricated moulding and extrusion for substantially improved properties in end applications

Type III — Lumpy materials of very fine particle size (average particle size 50 µ) for moulding of delicate parts which are required to have high mechanical and electrical properties and free from porosity for moulding of billets intended for skiving thin sheets for speciality application.

Type IV — Powder produced from a coagulated dispersion for extrusion used with a volatile/non-volatile extrusion aid.

5 GENERAL REQUIREMENTS

5.1 The powder shall be of uniform composition and shall contain no additives or foreign materials.

5.2 The colour of the powder shall be white and opaque.

5.3 Any limit of contamination are to be agreed upon by the purchaser and the manufacturer/suppliers.

5.4 Any limit of shrinkage of moulded billet are to be agreed upon by the purchaser and the manufacturer/ supplier.

5.5 The powders covered by this specification shall conform to the requirements detailed in Tables 1 and 2 when tested by the procedure specified therein. Table 1 lists those tests to be carried out on powders. Table 2 lists tests of moulded specimens.

5.6 The pourability of PTFE powders when determined in accordance with Annex H shall be reported.

6 SAMPLING

6.1 Unless otherwise agreed upon between the manufacturer/supplier and purchaser, the material shall be sampled in accordance with Annex J. Adequate statistical sampling prior to packaging shall be considered on acceptable alternative.

6.2 A batch or lot of moulding compound shall be considered as unit of manufacture as prepared for

Table 1 Requirements for the PTFE Moulding Powders

(*Clauses* 5.5, 7.1 *and* 7.2)

Sl No.	Characteristics	Types and Classes						Method of Test, Ref to Annex
		I	II		III	IV		
		Class 1	Class 1	Class 2	Class 1	Class 1	Class 2	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	Bulk density, g/l	700±100	875±100	750±100	425±100	400±50	400±50	A
ii)	Particle size (average diameter), µm	400±50	550±50	550±50	550±50	500±25	500±25	B
iii)	Retention in 1 000 µ sieve, percent, *Max*	15	18	15	—	10	10	B
iv)	Water content, percent, *Max*	0.04	0.04	0.04	0.04	0.04	0.04	C

Table 2 Requirements for the PTFE Moulded Specimen

(*Clauses* 5.5, 7.1 *and* 7.2)

Sl No.	Characteristics	Types and Classes						Method of Test, Ref to Annex
		I	II		III	IV		
		Class 1	Class 1	Class 2	Class 1	Class 1	Class 2	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	Specific gravity	2.14-2.18	2.14-2.18	2.14-2.18	2.14-2.18	2.16-2.18	2.16.2.18	D
ii)	Thermal stability index, (ΔR300), kg/cm^2, *Min*	← (–30) →						E
iii)	Tensile strength,kg/cm^2, *Min*	210	210	210	240	230	230	E
iv)	Elongation, percent, *Min*	200	200	200	300	300	300	E
v)	Tensile creep strain after 100 h, percent, *Max*		—	—	4.0	—	—	F
vi)	Dielectric constant at 1 MHz, *Max*	—	—	—	1.8 to 2.1	← 1.8 to 2.1 →		G
vii)	Dissipation factor at 1 MHz, *Max*	← ≤ 0.001 9 →			← ≤ 0.0003 →			G
	Moulding pressure, kg/cm^2	← 250 to 350 →			← 150 to 250 →			—
	Melting point, °C	← 327 ± 10 →						—

despatch and may consist of a blend of two or more 'production runs' materials.

7 NUMBER OF TESTS

7.1 Unless otherwise agreed upon between the manufacturer/supplier and purchaser, routine inspection tests shall be limited to selected tests in Tables 1 and 2 that are required to identify the material to the satisfaction of the purchaser.

7.2 All the tests listed in Tables 1 and 2 shall be used to establish conformity of a material to this specification. When the number of test specimens is not given in the test method, duplicate determinations, using two separate portions of the same sample shall be made. The average result for the test specimens tested shall conform to the requirements prescribed in this specification.

8 TEST SPECIMENS

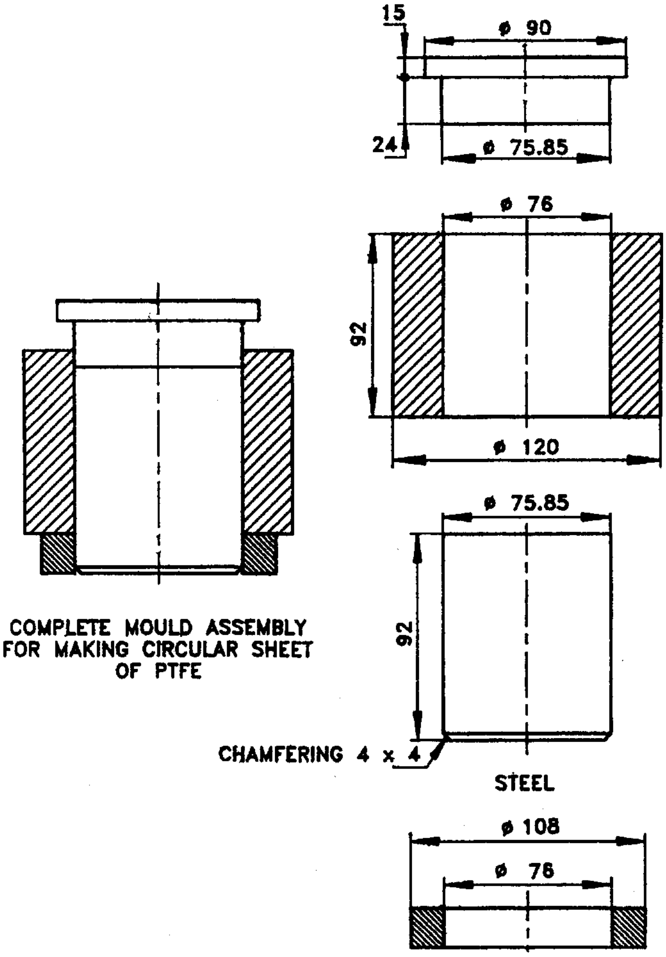
Test specimens shall be cut from disks moulded or skived tapes of 0.5 mm thickness in accordance with the procedure given in **9**.

9 SPECIMEN PREPARATION

9.1 Mould test disc of Type IV material in the die shown in Fig. 1. Place flat aluminium disc 0.08 to 0.38 mm thick and 76 mm in diameter on both sides of powders.

9.2 Screen 23 g of Type IV PTFE powder through 1.70 mm IS sieve into the mould. Adjust lower plug height so that the powder in the mould can be equalized using a fine stainless steel scriber. Insert the mould in suitable hydraulic press and apply pressure gradually until a total of 250 kg/cm^2 is attained. The final pressure is held for 3 min. Remove the disc from the mould and sinter by placing it in an air oven at 380°C. After five hours and fifteen minutes, place another disc in the oven horizontally as closer as possible to each other on a 2 mm thick aluminium plate placed in the oven.

Allow the temperature to rise to 380°C. After 6 h at 380°C, the two discs will have been heated respectively for 6 h and for 45 min leave to cool in the oven with ventilation at a 75 ± 5°C/h rate.



All dimensions in millimetres.

FIG. 1 MOULD ASSEMBLY

At about 280°C take out the discs from the oven, leave to cool in air to ambient temperature then bring into conditioned room at 23 ± 0.2°C for at least 12 h before tests are carried out.

9.3 Mould test billets for Types I, II and III materials in a die similar to Fig. 2, having an inside diameter of 150 mm and of sufficient height to contain the sample. A 250 mm length will produce a billet approximately 70 mm long from a powder charge. The billet length may be varied in accordance with the amount of testing to be done.

9.3.1 Screen a sample of powder to be tested (approximately through a 2 055 µ) aperture sieve screen.

Transfer the screened powder to the mould using the filling funnel. Ensure visually that the powder is evenly distributed in the mould assembly correcting any non-uniformity by gently rocking the mould assembly.

Position the pusher A on top of the pusher B place the whole mould assembly between platens of hydraulic press. Position the spacer bars between the mould case and bottom plate of the press (*see* Fig. 2). Apply an initial load to the mould of 100 kg/cm^2 ± 10 percent and hold for 1 to 2 min, then remove the spacer bar and apply final pressure in 3 to 5 min as recommended by the manufacturer for the particular grade of PTFE (*see* Table 2). Release the pressure slowly and force the preform vertically out of mould shell using continuous smooth movement.

9.3.2 Carefully eject the preform from the mould and identify using coloured wax pencil.

9.4 Following the preform moulding, allow a minimum period of 15 min, and then make following measurements for use in the determination of preform shrinkage during sintering.

Measure internal diameter of mould chamber by micrometer to ± 0.025 mm.

9.5 Place the preform on the perforated metal tray of sintering oven (air circulating oven) ensuring a gap of at least 35 mm between the preform and any others.

9.5.1 Heat the preform in the oven from 100 to 375°C at a rate of 55°C/h for Types I, II and III material. Hold the temperature for 4 h at 375°C and then reduce the temperature to 100°C at the same rate. Remove the billet and proceed with **9.6**.

9.6 Measurement of Billet Diameter Shrinkage

Measure by micrometer the diameter of sintered billet at five points selected at equal distant spacing around the diameter in the central portion of the billet and average them. Compute the diameter shrinkage as follows:

$$\text{Diameter shrinkage, percent} = \frac{D_1 - D_2}{D_1} \times 100$$

where

D_1 = Internal diameter of mould, and
D_2 = Diameter of sintered billet.

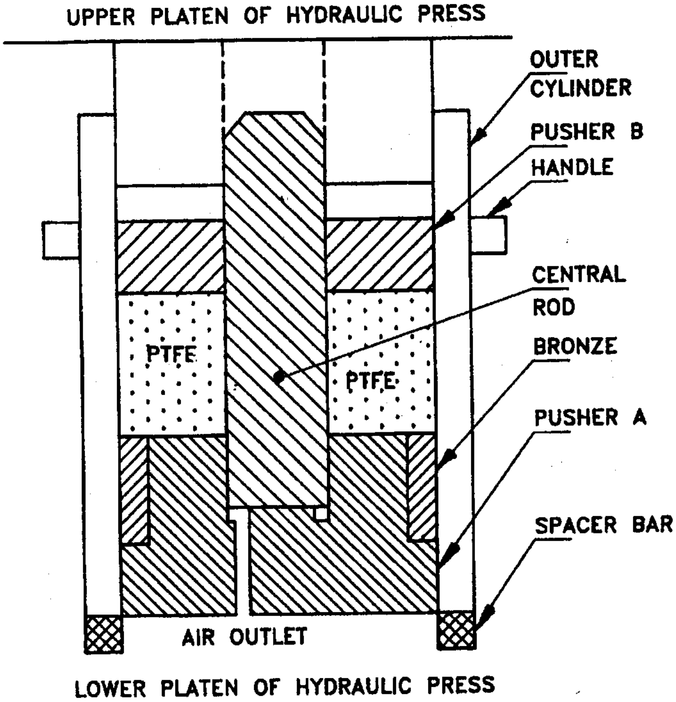


FIG. 2 MOULD ASSEMBLY (FOR TEST BILLETS)

9.7 Skiving of Test Billet

Prepare test specimen by skiving 0.5 mm thick tape for Types I, II and III materials for the determination of tensile strength and elongation. Discard the initial five revolutions of skived tape before taking the test sample. From the skived tapes, microtensile specimen as per Fig. 3 is to be punched out for said testing. For Type IV materials, same microtensile specimen is to be punched out from sintered disc as per **9.2**. For electrical testing 0.1 m thick tape are to be skived out for Types II and III materials.

10 CONDITIONING TEST SPECIMENS

For test of specific gravity and tensile properties the moulded test specimen (for specific gravity) and skived tapes shall be conditioned for a period of at least 12 h at standard laboratory temperature 23 ± 2°C prior to test unless otherwise specified. Since the resin does not absorb water, the maintenance of constant humidity during testing is not important.

11 PACKING AND MARKING

11.1 Packing

The material shall be packed in suitable containers as agreed between the purchaser and the supplier.

11.2 Marking

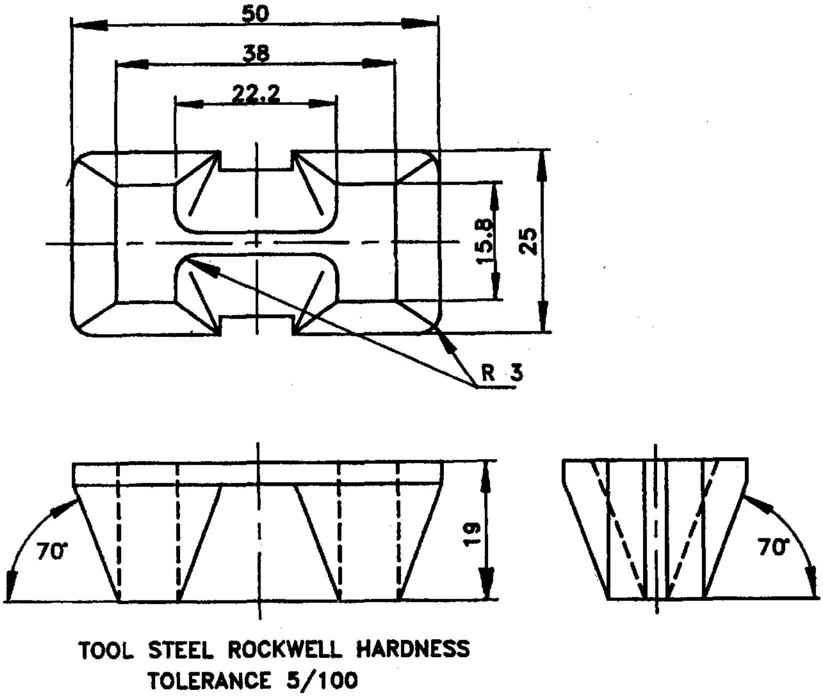
The packed containers shall be marked with the following informations:

a) Name of the material;
b) Type and class of the material;
c) Indication of the source of manufacture, recognized trade-mark, if any;
d) Net mass; and
e) Batch number or Code number.

11.3 BIS Certification Marking

The packed containers may also be marked with the Standard Mark.

11.3.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturer or producers may be obtained from the Bureau of Indian Standards.



All dimensions in millimetres.

FIG. 3 DETAILS OF MICROTENSILE SPECIMEN

ANNEX A

[*Table* 1, *Sl No.* (i)]

DETERMINATION OF BULK (APPARENT) DENSITY

A-1 GENERAL

Since the feeding of moulding and extrusion equipment for PTFE resin is often done on volumetric basis and it is necessary to know the apparent density of the material.

A-2 APPARATUS

A-2.1 A feeder fitted with a funnel (*see* Fig. 4).

A-2.2 Volumetric cup calibrated to 250 ml ± 0.5 ml at 25°C, standard size (*see* Fig. 5).

A-2.3 Cup stand fitted with standard levelling device (*see* Fig. 6).

A-2.4 Beaker, 80 ml capacity.

A-2.5 Standard 1.70 mm sieve.

A-3 SAMPLES

400 g of powder to be conditioned at least 4 h at 23 ± 2°C.

A-4 PROCEDURE

Dry screen the 400 g sample of polymer through the 1.70 mm sieve to eliminate cakes. Place the polymer on the feeder screen taking care to leave a free polymer fall from feeder outlet to top rim of cup between 2.5 and 3 mm.

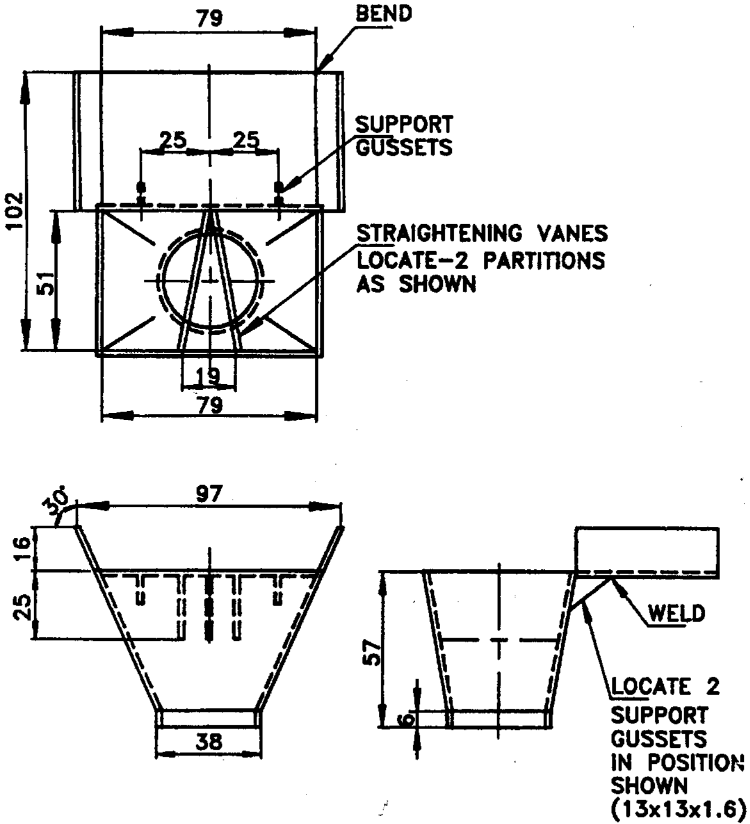
Set the vibration so that the measuring cup is filled in 20 to 30 s.

The polymer must form a mound and overflow, let the powder settle for 15 s then gently push the cups and its stand beneath the leveler. Exercise care to avoid agitating cups and contents while levelling.

Weigh the polymer to the accuracy of ± 1 g.

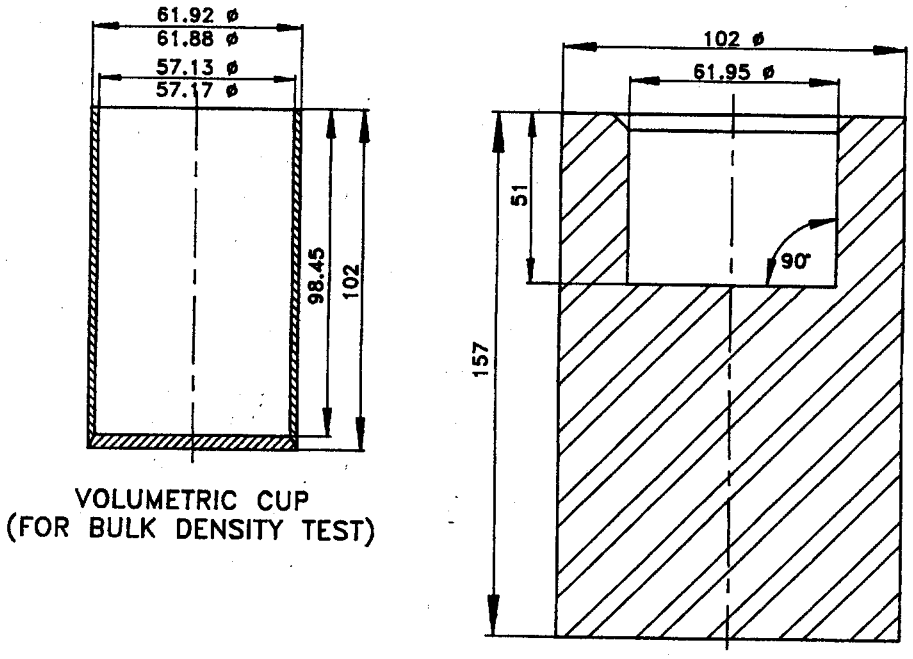
A-5 RESULTS

Apparent density in g/l = Grams of polymer × 4.


79
BEND
SUPPORT GUSSETS
25
25
102
51
STRAIGHTENING VANES LOCATE-2 PARTITIONS AS SHOWN
19
79
30°
97
16
25
38
57
6
WELD
LOCATE 2 SUPPORT GUSSETS IN POSITION SHOWN (13x13x1.6)

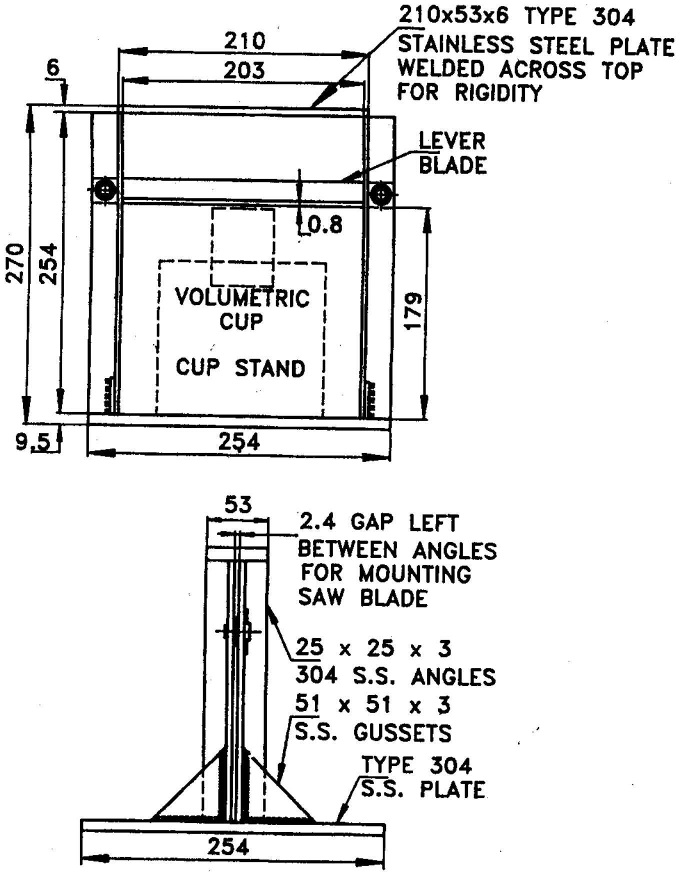
All dimensions in millimetres.

FIG. 4 FUNNEL (FOR BULK DENSITY TEST)



All dimensions in millimetres.

FIG. 5 CUP STAND (FOR BULK DENSITY TEST)



All dimensions in millimetres.

FIG. 6 LEVELER STAND (FOR BULK DENSITY TEST)

ANNEX B

[*Table* 1, *Sl No.* (ii) *and* (iii)]

DETERMINATION OF PARTICLE SIZE (SIEVE ANALYSIS)

B-1 GENERAL

According to the type of powder considered, wet sieve analysis (PTFE Types I, II, III and IV) or dry sieve analysis (PTFE Type II) is used. In either case a series of sieves are used in cascade.

Simplified methods enable the time required to be considerably shortened and these are used for routine checks.

B-2 WET SIEVE METHOD FOR PTFE TYPES I, II AND III

B-2.1 Apparatus

B-2.1.1 Apparatus for perchloroethylene stream (*see* Fig. 7) (for wet sieve analysis).

B-2.1.2 *Standard IS Sieves*

For PTFE Types										
I, II, IV Sieve opening, µ	1 000	850	600	425	300	212	150	63	45	37
III Sieve opening, µ	850	300	212	150	63	53	45	25		

B-2.1.3 Balance, able to weigh sieves to ± 0.1 g.

B-2.1.4 Tared 150 ml beakers.

B-2.1.5 Ventilated hood.

B-2.1.6 Drying oven at 110°C ± 5.

B-3 PROCEDURE

B-3.1 Weigh 50 g of powder to nearest 0.1 g.

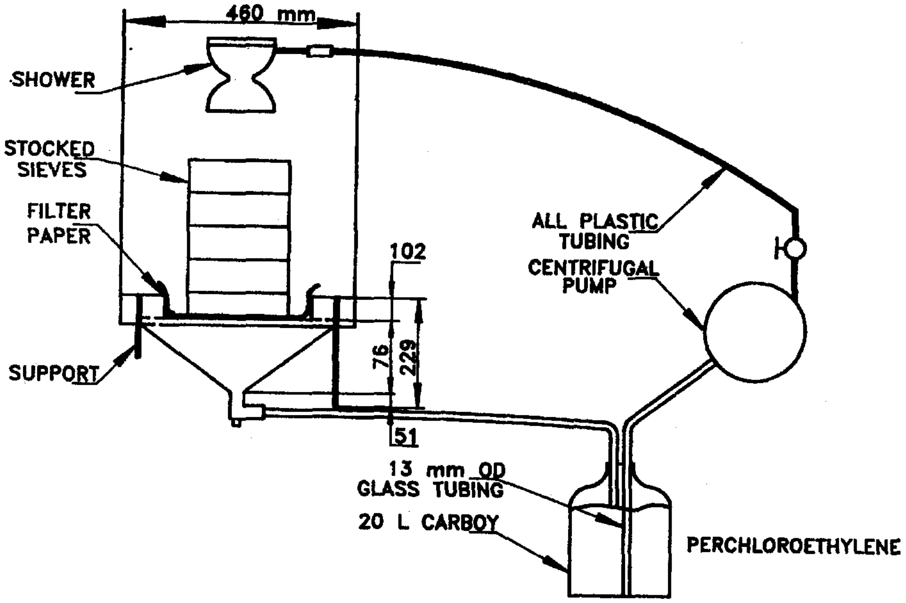
B-3.2 Stack the 8 sieves which have already been washed in order with finest at the bottom.

B-3.3 Place the 50 g of powder on the top sieve (1 000 µ).

B-3.4 Spray the top sieve with perchloroethylene at a rate of 6 ± 0.5 l/min keeping the shower head level with the top of sieve. Take care to break up all the agglomerates and to wash the material from the sides of the sieve. This spraying must last 1 min ± 12 s (*see* Fig. 7).

B-3.5 Remove sieve 1 000 µ — leave it to drain off and start spraying sieve 850 µ which is the following one, in the same way as above. Repeat this operation for all the sieves except 45 µ which is only used to stop the very finest particles and prevent them reaching the perchloroethylene bottle.

B-3.6 Dry the sieves for 1 h in the oven at 110°C and leave them to cool down to ambient temperature.



All dimensions in millimetres.

FIG. 7 PERCHLOROETHYLENE STREAM (FOR PARTICLE SIZE TEST)

B-3.7 Weigh the sieves and calculate the amount of powder collected on each sieve.

Net percentage of polymer on sieve X = 2 × weight in g of polymer on sieve X.

B-3.8 Clean the sieves using a dry cloth then by an air blast.

B-3.9 Calculation of Distribution Function (*DF*)

B-3.9.1 One can for instance have the following results (for Type I):

Sieve Opening (µ)	*g of Powder*	*Percentage Retained*	*Cumulative Percentage Retained*
1 000	0.5	1.0	1.0
850	1.15	2.3	3.3
600	10.70	21.4	24.7
425	20.30	40.60	65.1
300	12.65	25.30	90.6
212	3.30	6.60	97.2
150	0.60	1.20	98.4
63	0.20	0.40	98.8

B-3.9.2 Plot these results on log/probability paper noting as ordinates the particle size corresponding to each sieve and as abscissa the cumulative percentage of powder retained by each sieve. Draw a straight line corresponding to the whole of the points (*see* Fig. 8).

B-3.9.3 Read from this straight line:

- the average particle size *d*50 at 50 percent
- the particle sizes *d*16 and *d*84 at 16 and 84 percent
- Calculate the distribution function

$$DF = \frac{d50 - d84}{d50}$$

B-3.10 Particle Size of PTFE Type III

B-3.10.1 Weigh 10 g of PTFE Type III in 150 ml washed beaker.

B-3.10.2 Fit sieve 850 µ on sieve 300 µ.

B-3.10.3 Pour the contents of one beaker on the sieve 850 µ and spray with perchloroethylene as in **B-3.4** for 4 min at a flowrate of 6 ± 0.5 l/min. No trace of powder must remain on sieve 850 µ which is only used to break up the powder.

B-3.10.4 Leave the sieve to drain and repeat the operation placing the sieve 850 µ on each of other 7 sieves in turn.

B-3.10.5 Dry the sieves for 1 h in 110°C oven.

B-3.10.6 Weigh the sieves and calculate the weight of powder retained on each.

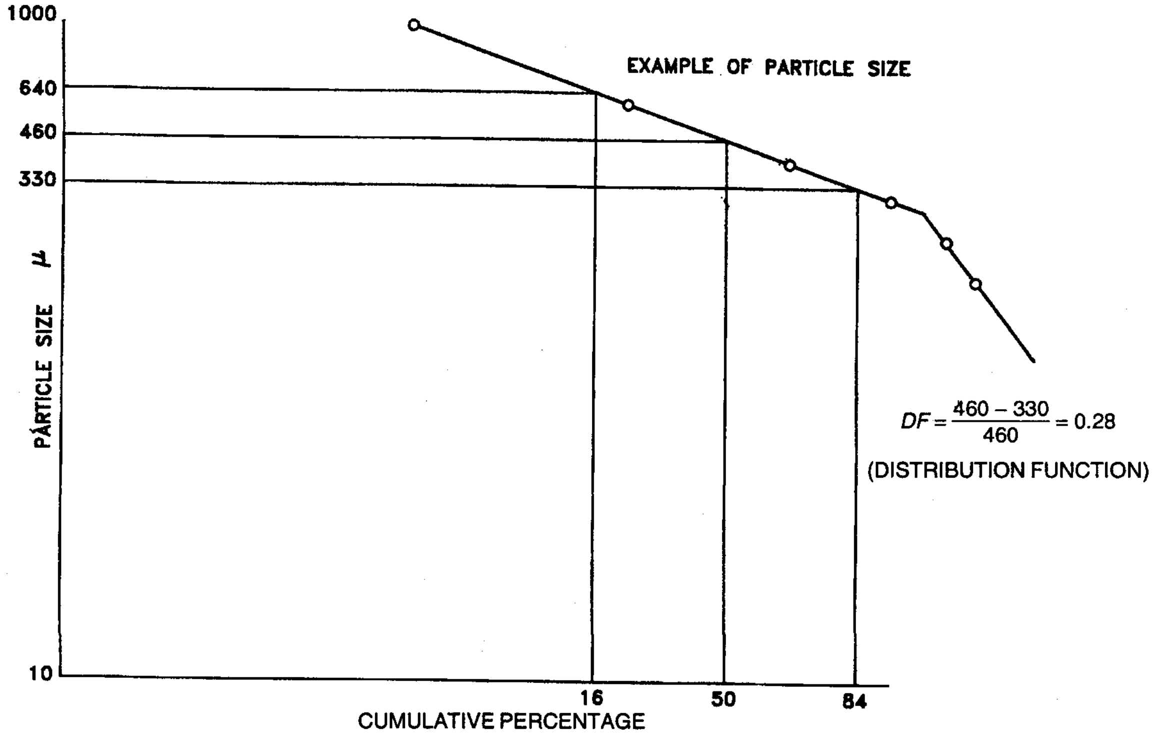


FIG. 8 GRAPHICAL REPRESENTATION FOR PARTICLE SIZE

B-3.10.7 One may have for instance the following results (for Type III):

Sieve Opening (μ)	*g of Powder Retained*	*Percentage of Powder Retained*
300	0.1	1
212	0.1	1
150	0.4	4
63	2.8	28
53	4.7	47
45	5.6	56
25	8.0	80

B-3.10.8 Plot these results on log/probability paper in the same way as in **B-3.9.2** and calculate the average particle size and the distribution function.

B-4 SIMPLIFIED METHOD

B-4.1 The number of sieves is smaller than in the general method; the procedure takes less time but differs according to PTFE Types I, II, IV and III.

B-4.2 For PTFE Types I, II, IV

The apparatus required is the same as for general method except as far as sieves are concerned,see the sieve opening given below:

PTFE Types I, II and IV Sieve opening, μ	1 000	500	300	32

B-4.3 Procedure

B-4.3.1 Weigh 50 g of powder to nearest 0.1 g.

B-4.3.2 Stack the 3 sieves which have already been washed in order with finest at the bottom.

B-4.3.3 Place the 50 g powder on the top sieve (1 000 μ).

B-4.3.4 Spray the top sieve with perchloroethylene using shower head at a rate of 6 ± 0.5 l/min. Keep the shower head level with top of sieve, taking care to break up all the agglomerates and to wash the material from the sides of the sieve. Do not touch the bottom filter paper which is only used to stop the very finest particles and prevent them reaching the perchloroethylene tank.

B-4.3.5 Dry the two upper sieves for 1 h at 110°C and leave them to cool down to ambient temperature.

B-4.3.6 Weigh the two sieves and calculate the amount of powder collected on each sieve.

B-4.3.7 Express this weight as a percentage of the powder tested:

Percentage retained = 2 × weight in g of polymer on sieve.

B-4.3.8 Calculate the cumulative percentage retained. One can for instance have for PTFE Type I the following results:

Sieve Opening (μ)	*g of Powder Retained*	*Percentage Retained*	*Cumulative Percentage Retained*
1 000	0.6	1.2	1.2
300	42.1	84.2	85.4

B-4.4 For PTFE Type III

B-4.4.1 The apparatus required is the same as for general method except that the sieves are as follows:

PTFE Type III, Sieve opening, μ	850	53	32

B-4.4.2 As in the general method, the shower head perchloroethylene spray is used to break up all the agglomerates and to prevent clogging up the sieves.

B-4.4.3 Weigh 10 ± 0.01 g of PTFE Type III. Stack the sieves with the 850 μ on top of the 53 μ. Set the perchloroethylene flow rate to 6 ± 0.5 l/min.

B-4.4.4 Place the weighed sample on the top sieve (850 μ) and spray with perchloroethylene for exactly 1 min. Use a stop watch. The shower head must be moved regularly all round. Break up all the agglomerates and wash the material from the sides of the sieve.

B-4.4.5 Remove the 850 μ sieve and spray the 53 μ sieve for exactly 6 min using the stopwatch again. During the last minute, use the perchloroethylene spray to drive the powder towards the edges of the sieve.

B-4.4.6 Dry in the oven for atleast 20 min at 80 to 120°C until the odour of solvent has disappeared. The 850 μ sieve does not have to be dried.

B-4.4.7 Place the powder retained on the 53 μ sieve on a filter paper by overturning it. Use a stiff brush to free the produce which may be stuck in the mesh. Place the dry powder in a tared weighing dish and weigh to ± 0.01 g. The previously washed sieve can alternatively be weighed.

B-4.4.8 Calculate the percentage of retained polymer on the 53 u sieve as follows:

$$\text{Amount retained } (p), \text{ percent} = \frac{\text{weight retained}}{\text{sample weight}} \times 100$$

Two measurements shall be carried out and both results shall be expressed.

B-5 DRY METHOD

Dry screening is used.

B-5.1 Apparatus

B-5.1.1 A balance able to weigh sieves to ± 0.1 g.

B-5.1.2 A FRITECH sieve analyzer

B-5.1.3 IS standard sieves

PTFE Type II, Sieve opening, µ	1 000	850	600	425	300	212	150	45

B-5.2 Standard Procedure

B-5.2.1 The standard sieves are cleaned using compressed air then placed on the sieve shaker.

B-5.2.2 Place 50 ± 0.1 g of powder on top sieve.

B-5.2.3 Set the sieve shaker to position 6 (vibrations).

B-5.2.4 Sieve for 12 minutes (time set to 20).

B-5.2.5 Weigh and calculate as in **B-4**.

B-5.3 Simplified Method

The procedure is the same as **B-5.2** except for the number of sieves (reduced to 3) 1 000 µ, 425 µ and 45 µ, whereas the percentage of polymer retained is calculated on each of the top two sieves.

Amount retained (p), percent = 2 × weight in g of polymer retained

B-6 RESULTS

B-6.1 The analyzed powders comply with particle size standards if, using normal methods:

Powder	*G, 50 percent,* µ	ΔF (*Max*)
Type I	400 ± 50	0.40
Type III	~ 50	—
Type II	550 ± 50	0.40
Type IV	500 ± 25	0.40

B-6.2 If using simplified methods:

Powder	*Percentage Retained in Sieve* 1 000 µ (*Max*)	*Percentage Retained in Sieve* 53 µ (*Max*)
Type I	15	—
Type III	—	50
Type II	18	—
Type IV	15	—

B-6.3 The cumulative percentage retained on both sieves is calculated and noted down, but is not used to determine the classes.

ANNEX C

[*Table* 1, *Sl No.* (iv)]

DETERMINATION OF WATER CONTENT

C-1 GENERAL

The water content remaining in the polymer is determined after drying.

C-2 APPARATUS

C-2.2 Pyrex petri dishes dia 70 mm, height 38 mm approx.

C-2.3 Precision balance to 1/10th mg.

C-2.4 Desiccator

C-3 PROCEDURE

C-3.1 Wash two petri dishes in acetone, dry them in the vacuum oven at 110°C and left them to cool in a desiccator. The dishes are then tared to ± 0.1 mg (P).

C-3.2 Weigh 10 ± 0.1 g of PTFE in each of the two dishes. Leave in the oven at 110 ± 10°C for 2 h. Cool in the dessicator and weigh half an hour later. The weight to be recorded to the nearest 0.000 1 g.

C-4 CALCULATION

$$\text{Water content in ppm} = \frac{P - P''}{P - P'} \times 10^6$$

P = weight of petri dish + polymer before going into oven,

P' = weight of empty petri dish, and

P'' = weight of petri dish + polymer after coming out of oven.

Take the average of the two determinations.

C-5 ALTERNATIVE METHOD FOR DETERMINATION OF WATER CONTENT BY KARL-FISCHER REAGENT

Weigh 35 ± 1 g of powder in a glass stoppered flask containing about 50 ml of pretitrated methanol. Shake to mix with swirling motion for a few minutes. Titrate visual or electrometric end point.

ANNEX D

[*Table* 2, *Sl No.* (i)]

DETERMINATION OF SPECIFIC GRAVITY

D-1 PROCEDURE

Determine specific gravity of Type IV material on moulded discs (*see* **9.1**). Take specimens of Type I, II and III materials from the centre portion of the sintered billet (*see* **9.3**). The specimen shall be in approximately cubical in shape and weigh from 10 to 25 g or the entire billet core remaining from the skiving of tape may be used. Make determination in accordance with the procedures given in IS 13360 (Part 3/Sec 1)/ISO 1183. Add 2 drops of a wetting agent (triton × 100) to the water in order to reduce the surface tension and ensure complete wetting of the disc.

ANNEX E

[*Table* 2, *Sl No.* (ii), (iii) *and* (iv)]

DETERMINATION OF TENSILE PROPERTIES AND THERMAL STABILITY TEST

E-1 DEFINITIONS AND PURPOSE

This determination aims at checking the mechanical properties of a moulded sheet produced under standard conditions from the powder being assayed. It, therefore, enables the intrinsic polymer properties to be checked. The thermal stability is given by comparing these properties between sheets baked under very different conditions.

E-2 APPARATUS

E-2.1 IS standard sieve, 1.70 mm.

E-2.2 Balance, able to weigh the powder to ± 0.1 g.

E-2.3 Mould (*see* Fig. 1).

E-2.4 Laboratory press (16T force at least).

E-2.5 Forced ventilation oven with temperature controlled to 380 ± 2°C in area where sheets are located.

E-2.6 Stamp or cutter for standard tensile specimens (*see* Fig. 3).

E-2.7 Recording dynamometer placed in a room held at 23 ± 2°C.

E-2.8 Dial gauge reading, 1/100th mm.

E-3 PROCEDURE

E-3.1 Pre-Shaping Sheets

E-3.1.1 Sieve the powder through 1.70 mm sieve.

E-3.1.2 Weigh 23 g of powder for each sheet to be made.

E-3.1.3 Place the powder in the mould and equalize using a fine stainless steel scriber.

E-3.1.4 Lay under press and compress with a 350 kg/cm^2 pressure, which is to be increased from 0 to 350 in 120 ± 5 s. The final pressure is held for 3 min.

(The discs obtained just have a homogenous texture when candled).

E-3.2 Sintering

E-3.2.1 Bring into the oven at 380°C a sheet intended for thermal stability determination.

E-3.2.2 After 5 h and 15 min, bring into the oven a second sheet (the two sheets will be laying horizontally as close as possible to each other on a 2 mm thick aluminium plate).

E-3.2.3 Allow the temperature to rise to 380°C.

E-3.2.4 After 6 h at 380°C, the two sheets will have been heated respectively for 6 h and for 45 min, leave to cool in oven with ventilation on, at a 75 ± 5°C/h rate.

E-3.2.5 At 280°C remove the sheets on the aluminium plate support. Leave to cool in air to ambient temperature, then bring into conditioned room at 23 ± 2°C for at least 12 h before tests are carried out.

NOTE — It is very important to recheck the cooling schedule, otherwise, disc crystallinity and resulting physical properties may be notably altered.

E-3.3 Tests

E-3.3.1 Cut from each disc/skived tapes, three standard test pieces.

E-3.3.2 Determine section to nearest 0.01 mm using dial gauge.

E-3.3.3 Fit the test piece in clamps of dynamometer, while setting the gap to exactly 22.2 mm.

E-3.3.4 Set the recorder according to cross section of each test piece.

E-3.3.5 Carry out tensile test on both test pieces at a speed of 50 mm/min, recording on the same chart both tensile graphs regarding test pieces baked for 45 min and two tensile graphs regarding test pieces baked for 6 h.

E-3.3.6 For each pair of graphs, trace the average.

E-3.3.7 If one curve is not normal, carry out a tensile test on the third test piece.

NOTE — Make sure before use that cutter is in good condition, particularly no indentations.

E-4 RESULTS

E-4.1 Tensile strength and percent extension at rupture are given by the coordinates of rupture point of average graph of test-pieces sintered for 45 min.

E-4.2 The yield point is the first point on the graph from which the extension increases without a corresponding increase in stress. When the chart has a horizontal part, the yield point is the beginning of this horizontal part. When the chart has a summit, the yield point is at the horizontal tangent line to this summit.

E-4.3 The yield point is expressed in kg/cm^2.

E-4.4 The inflection point is the spot where the chart changes its deflection without having a summit or a horizontal part; it is also expressed in kg/cm^2.

E-4.5 The thermal stability is indicated by the range between two average tensile charts after 45 min and 6 h sintering. For this measure the range between charts at 300 percent extension (if necessary, charts to be extrapolated), calculate this range $\Delta R\ 300 \geq -30$ kg/cm^2 with +sign if 6 h chart is above 45 min chart, and –sign if the opposite occurs. Thermal stability will be conisdered good when $\Delta R\ 300 \geq -30$ kg/cm^2.

ANNEX F

[*Table* 2, *Sl No.* (v)]

DETERMINATION OF TENSILE CREEP

F-1 GENERAL

F-1.1 This method is for determining the tensile creep of plastics in the form of standard test specimens under specified conditions such as those of pretreatment, temperature and humidity and the tensile creep is determined for Type III.

F-1.2 The method is suitable for use with rigid and semi-rigid non-reinforced, filled and fibre-reinforced plastics materials in the form of dumb-bell-shaped test specimens moulded directly or machined from sheets or moulded articles.

F-1.3 The method is intended to provide data for engineering-design and research and development purposes.

F-1.4 Tensile creep may vary significantly with differences in specimen preparation and dimensions and in the test environment. Consequently, when precise comparative results are required, these factors must be carefully controlled.

F-1.5 If tensile-creep properties are to be used for engineering-design purposes, the plastics, materials should be tested over a broad range of stresses, times and environmental conditions.

F-2 APPARATUS

F-2.1 Gripping Device

Capable of ensuring that the direction of the load applied to the test specimen coincides as closely as possible with the longitudinal axis of the specimen. This ensures that the test specimen is subjected to simple stress and that the stresses in the loaded section of the specimen may be assumed to be uniformly disturbed over cross section perpendicular to the direction of the applied load.

NOTE — It is recommended that grips be used that will allow the specimen to be fixed in place, correctly aligned, prior to applying the load. Self-locking grips which allow the specimen to move as the load increases are not suitable for this test.

F-2.2 Loading System

Capable of ensuring that the load applied smoothly, without causing transient overloading, and that the load is maintained to within ± 1 percent of the desired load. In creep-to-rupture tests, provision shall be made to prevent any shocks which occur at the moment of rupture being transmitted to adjacent loading systems. The loading mechanism shall allow rapid, smooth and reproducible loading.

F-2.3 Extension-Measuring Device

Comprising any contactless or contact device capable of measuring the extension of the specimen gauge length under load without influencing the specimen behaviour by mechanical effects (for example, undesirable deformations, notches), other physical effects (for example, heating of the specimen) or chemical effects. In the case of longitudinal axis of the specimen shall be perpendicular to the optical axis of the measuring device. The accuracy of the extension-measuring device shall be within ± 0.01 mm.

For creep-to-rupture tests, it is recommended that the extension be measured by means of a contactless optical system operating on the cathetometer principle. Automatic indication of time to rupture is highly desirable. The gauge length shall be marked on the specimen, either by attaching (metal) clips with scratched-on gauge marks, or by gauge mark ruled with an inert, thermally stable paint.

Electrical-resistance strain gauges are suitable only if the material tested is of such a nature as to permit such strain gauges to be attached to the specimen by means of adhesive and only if the adhesion quality is constant during the duration of the test.

F-2.4 Time-Measurement Device

Accurate to 0.1 percent.

F-2.5 Micrometer

Reading to 0.01 mm or closer, for measuring the thickness and width of the test specimen.

F-3 TEST SPECIMENS

Use test specimens of the same shape and dimensions as specified for the determination of tensile properties [*see* IS 13360 (Part 5/Sec 2)/ISO 527-2].

F-4 PROCEDURE

F-4.1 Conditioning and Test Atmosphere

Condition of test shall be 5.52 MPa stress at the standard laboratory temperature of 23 ± 2°C for a test duration of a minimum of 100 h.

F-4.2 Measurement of Test-Specimen Dimensions

Measure the dimensions of the conditioned test specimens in accordance with IS 13360 (Part 5/ Sec 1)/ISO 527-1.

F-4.3 Mounting the Test Specimen

Mount a conditioned and measured specimen in the grips and set up the extension-measuring device as required.

F-4.4 Selection of Stress Value

Select a stress value appropriate to the application envisaged for the material under test, and calculate, using the equation given in **3.5**, the test load to be applied to the test specimen.

F-4.5 Loading Procedure

F-4.5.1 *Preloading*

When it is necessary to preload the test specimen prior to increasing the load to the test load, for example, in order to eliminate backlash by the test gear, take care to ensure that the preloaded does not influence the test results. Do not apply the preload until the temperature and humidity of the test specimen (gripped in the test apparatus) correspond to the test conditions. Measure the gauge length after application of the preload. Maintain the preload during the whole duration of the test.

F-4.5.2 *Loading*

Load the test specimen progressively so that full loading of the test specimen is reached between 1 and 5 s after the begining of the application of the load. Use the same rate of loading for each of a series of tests on one material.

Take the total load (including the preload) to be the test load.

F-4.6 Extension-Measurement Schedule

Record the point in time at which the specimen is fully loaded as $t = 0$. Unless the extension is automatically and/or continuously recorded, choose the times for marking individual measurements as a function of the creep curve obtained from the particular material under test. It is preferable to use the following measurement schedule:

1 min, 3 min, 6 min and 30 min;

1 h, 2 h, 5 h, 10 h, 20 h, 50 h, 100 h, 200 h, 500 h, 1 000 h, etc.

If discontinuities are suspected or encountered in the creep-strain versus time plot, take readings more frequently than recommended above.

F-4.7 Time Measurement

Measure, to within ± 0.1 percent or ± 2 s (whichever is the less severe tolerance), the total time which has elapsed up to each creep measurement.

F-4.8 Temperature and Humidity Control

Unless temperature and relative humidity (where applicable) are recorded automatically, record them at the begining of the test and then at least three times a day initially. When it has become evident that the conditions are stable within the specified limits, they may be checked less frequently.

F-4.9 Measurement of Recovery Rate (Optional)

Upon completion of non-rupture tests, remove the load rapidly and smoothly and measure the recovery rate using, for instance, the same schedule as was used for creep measurement.

F-5 EXPRESSION OF RESULTS

F-5.1 Method of Calculation

Calculate the tensile-creep modulus ε_t by dividing the initial stress σ by the strain ε_t at each of the selected measurement times.

It is given, in megapascals, by the equation

$$\varepsilon_t = \frac{\sigma}{\varepsilon_t} = \frac{F.L_0}{A.(\Delta L)_t}$$

where

F = the applied force, in newtons,

L_0 = the initial gauge length, in mm,

A = the initial cross-sectional area, mm^2, of the specimen, and

$(\Delta L)_t$= the extension, in mm, at time t.

F-5.2 Presentation of Results

F-5.2.1 *Creep Curves*

If testing is carried out at different temperature, the raw data should preferably be presented, for each temperature, as a series of creep curves showing the tensile strain plotted against the logarithm of time, one curve being plotted for each initial stress used (*see* Fig. 9).

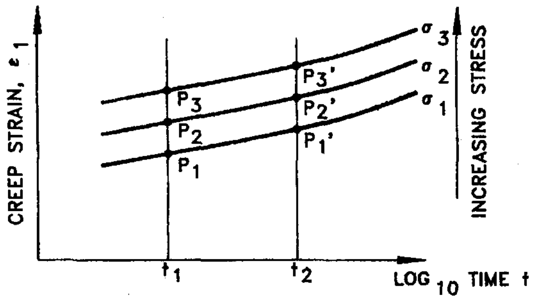


FIG. 9 CREEP CURVES

The data may also be presented in other ways, for example, as described in **F-5.2.2** and **F-5.2.3**, to provide information required for particular applications.

F-5.2.2 *Creep-Modulus/Time Curves*

For each initial stress used, the tensile-creep modulus, calculated in accordance with **F-5.1**, may be plotted against the logarithm of the time under load (*see* Fig. 10).

If testing is carried out at different temperatures, plot a series of curves for each temperature.

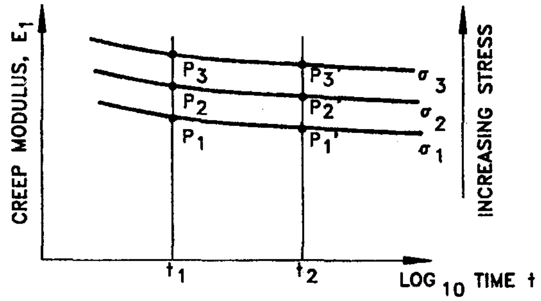


FIG. 10 CREEP-MODULUS/TIME CURVES

F-5.2.3 *Isochronous Stress-Strain Curves*

As isochronous stress-strain curve is a Cartesian plot showing how the strain depends on the applied load, at a specific point in time after application of the load. Several curves are normally plotted, corresponding to times under load of 1 h, 10 h, 100 h, 1 000 h, and 10 000 h. Since each creep test gives only one point on each curve, it is necessary to carry out the test at atleast three different stresses, and preferably, more to obtain an isochronous curve.

To obtain an isochronous stress-strain curve for a particular time under load (say 10 h) from a series of creep curves as shown in Fig. 9, read off, from each creep curve, the strain at 10 h, and plot these strain values (x-axis) against the corresponding stress values (y-axis). Repeat the process for the other times to obtain a series of isochronous curves (*see* Fig. 11).

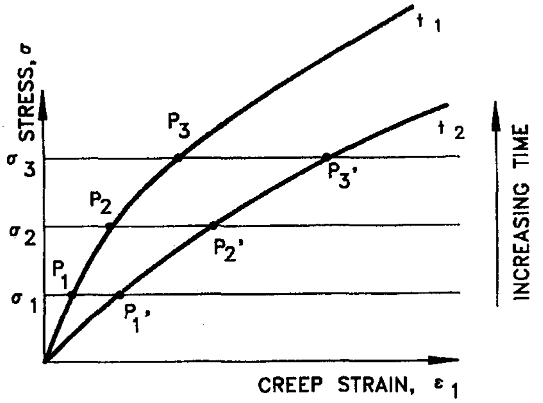


FIG. 11 ISOCHRONOUS STRESS-STRAIN CURVES

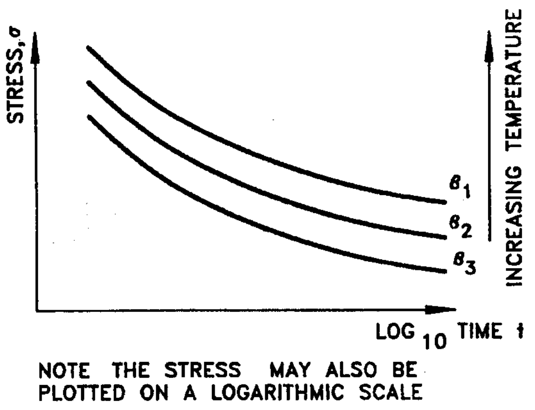
If testing is carried out at different temperature, plot a series of curves for each temperature.

F-5.2.4 *Three-Dimensional Representation*

A relationship of the form $\varepsilon = f,(t, \sigma)$ exists between the different types of curve (*see* Fig. 9 to 11) that can be derived from the raw creep-test data. This relationship can be represented as a surface in a three-dimensional space.

All the curves that can be derived from the raw creep-test data form part of this surface. Because of the experimental error inherent in each measurement, the points corresponding to the actual measurements normally do not lie on the curves but just off them.

The surface $\varepsilon = f(t, \sigma)$ can, therefore, be generated by deriving a number of the curves which form it, but a number of sophisticated smoothing operations are usually necessary. Computer techniques permit this to be done rapidly and reliably.



NOTE — The stress may also be plotted on a logarithmic scale.
FIG. 12 CREEP-TO-RUPTURE CURVES

F-5.2.5 *Creep-to-Rupture Curves*

Creep-to-rupture curves allow the prediction of the time to failure at any stress. They may be plotted as stress against log time (*see* Fig. 12) or log stress against log time.

ANNEX G

[*Table* 2, *Sl No.* (vi) *and* (vii)]

DETERMINATION OF DIELECTRIC CONSTANT

G-1 Determine dielectric constant and dissipation factor in accordance with the method described in IS 4486.

ANNEX H

(*Clause* 5.6)

DETERMINATION OF POURABILITY

H-1 GENERAL

Make sure that free flowing PTFE powders (217 ± 0.1 g) intended particularly for feeding automatic moulding machines have readiness to flow regularly and continuously within determined time limits.

H-2 OUTLINE OF THE METHOD

The time taken for a standard quantity of powder (217 ± 0.1 g) to discharge through the calibrated orifice of a fixed dimension (*see* Fig. 13) funnel is measured.

H-3 APPARATUS

H-3.1 A balance to weigh 200 to 300 g to the nearest 0.1 g.

H-3.2 A standard funnel (*see* Fig. 13) held by a stand.

H-3.3 A 500 cc measuring cylinder.

H-3.4 A stopwatch reading tenths of a second.

H-4 PROCEDURE

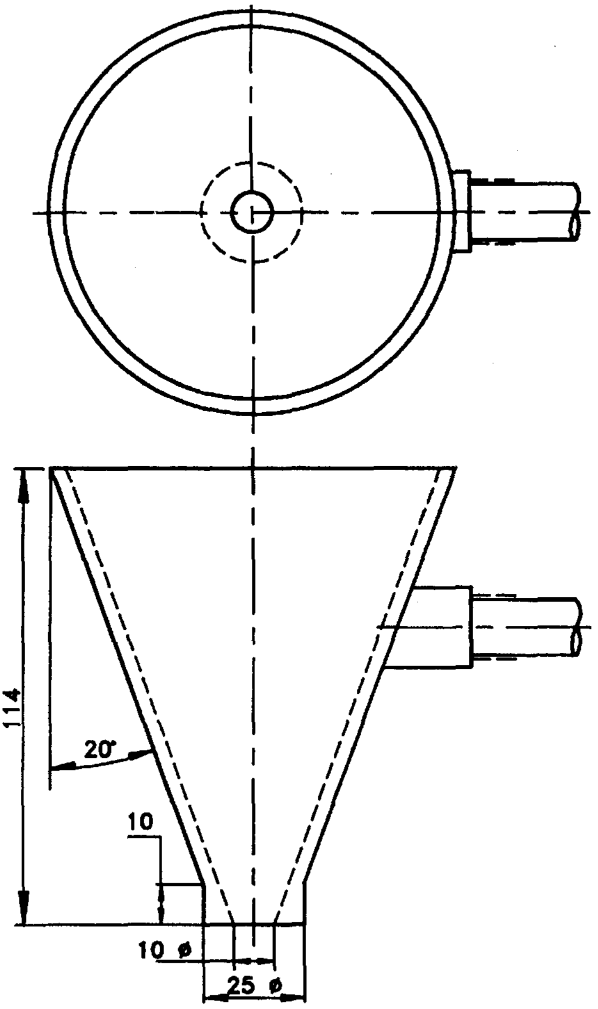
H-4.1 If required, work this sample on a paper until there is no tendency to pack or cake. Close the small end of the funnel and pour the sample lightly into the funnel avoiding any tendency to pack it. Quickly open the bottom of the funnel and start the stop watch at the same instant.

H-4.2 Allow the powder to run freely from the funnel and stop the watch at the instant the last of it leaves the funnel.

H-4.3 If the powder stops running, it is classified as 'will not pour'.

H-5 RESULTS

Report in seconds to ± 0.2 s the time taken for funnel to discharge, for example, PTFE Type II will be class 1, if the pourability is 20 s. For PTFE Type I, the value is noted but is not used in classifying the grade.



STANDARD ALUMINIUM FUNNEL, INSIDE POLISHED

All dimensions in millimetres.

FIG. 13 STANDARD ALUMINIUM FUNNEL

ANNEX J

(*Clause* 6.1)

SAMPLING OF POLYTETRAFLUOROETHYLENE (PTFE) MOULDING MATERIALS

J-1 GENERAL REQUIREMENTS OF SAMPLING

J-1.1 Sample shall not be taken in an exposed place.

J-1.2 The sampling instrument, which shall be made of glass, stainless steel or any other material on which polytetrafluoroethylene moulding material has no action, shall be clean and dry.

J-1.3 Precautions shall be taken to protect the samples, the material being sampled, the sampling instrument and containers selected for sampling from adventitious contamination.

J-1.4 To draw a representative sample, the contents of each container selected for sampling shall be mixed as thoroughly as possible by suitable means.

J-1.5 The sample shall be placed in suitable, clean, dry, air-tight sheet metal or glass containers on which the material has no action.

J-1.6 Each sample container shall be sealed air-tight with a stopper after filling and marked with full details of sampling, the date of sampling and the month and year of manufacture of the material.

J-2 SCALE OF SAMPLING

J-2.1 Lot

All the containers in a single consignment of the material drawn from a single batch of manufacture shall constitute a lot. If a consignment is declared or known to consist of different batches of manufacture, the batches shall be marked separately and the groups of containers in each batch shall constitute separate lots.

J-2.2 A number of containers, consisting 10 percent of the containers in a lot but not less than 3 containers in any case, shall be selected at random from a lot for the purpose of drawing samples for test (*see* IS 4905).

J-3 TEST SAMPLES AND REFEREE SAMPLE

J-3.1 Preparation

To prepare a set of test samples, draw with an appropriate sampling instrument, from freshly opened containers which have been selected for sampling, an equal number of scoopfuls of material from any point at least 75 mm below the surface and 75 mm above the bottom of large containers, and from any point at least 25 mm below the surface and 25 mm above the bottom of small containers. The sample prepared by mixing the portions from each container shall be not less than eight times the quantity which is estimated to be required for carrying out all the tests. Divide this composite sample into the required number of reduced samples. Each set of these reduced samples shall constitute the test sample.

J-3.2 Three sets of test samples, each not less than twice the quantity required for the purpose of testing, representative of each selected container (*see* **J-3.1**) shall be transferred immediately to thoroughly dried containers, which shall be sealed air-tight with an appropriate stopper. These containers shall be marked with all the particulars of sampling given under **J-1.6**. One set of the test samples shall be sent to the purchaser and one to the supplier.

J-3.3 Referee Sample

The third set of the test samples, bearing the seals of the purchaser and the supplier shall constitute the referee sample, to be used in case of dispute between the purchaser and the supplier. It shall be kept at a place agreed to between the purchaser and the supplier.

J-4 TEST FOR ACCEPTANCE

J-4.1 Examination and Tests

The purchaser may examine and test separately samples from each of the lots (*see* **J-2.1**) for compliance with the requirements of the standard, or he may prepare for the purpose of such examination, a composite sample representing the whole of the consignment, by mixing the test samples.

(*Continued from second cover*)

This wide scope of PTFE materials has now demanded a national standard to specify accurately those properties of the material which would satisfy their specific requirements.

While preparing this standard considerable assistance has been derived from the following publications:

ISO 899-1 : 1993 'Plastics — Determination of creep behaviour Part 1: Tensile creep' issued by the International Organization for Standardization (ISO).

ASTM D 1457 : 1990 'Standard specification for polytetra fluoroethylene (PTFE) moulding and extrusion materials' issued by the American Society for Testing and Materials, ANSI, USA.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in the standard.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. PCD 12 (1211).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :		Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110 002	323 76 17 323 38 41
Eastern	: 1/14 C. I.T. Scheme VII M, V. I. P. Road, Kankurgachi CALCUTTA 700 054	337 84 99, 337 85 61 337 86 26, 337 91 20
Northern	: SCO 335-336, Sector 34-A, CHANDIGARH 160 022	60 38 43 60 20 25
Southern	: C. I. T. Campus, IV Cross Road, CHENNAI 600 113	235 02 16, 235 04 42 235 15 19, 235 23 15
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400 093	832 92 95, 832 78 58 832 78 91, 832 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM.

Printed at Printograph, New Delh, Ph.: 5726847